

High Efficiency, Easy-to-Manufacture Engineered Nanomaterials for Thermoelectric Applications, Phase II

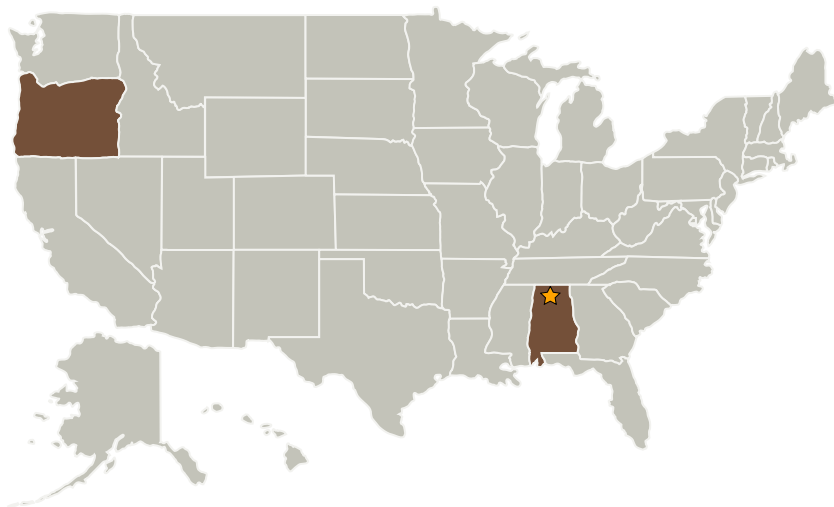
Completed Technology Project (2006 - 2008)



Project Introduction

Leveraging the successful Phase I SBIR program, a 24-month effort is proposed to optimize and demonstrate a high thermoelectric Figure-of-Merit (ZT) nanocrystal quantum dot (NQD) thermoelectric (TE) material, which will have thermal efficiency properties far better than traditional bulk thermoelectric materials. In the proposed work, a series of TE devices will be fabricated from solidified NQD films formed from colloiddally synthesized NQDs using consolidation and second phase precipitation. The increase of ZT, is dependent on quantum confinement of electrons and holes, as well as the phonon dynamics and transport of the materials. If the size of a semiconductor is smaller than the mean free path of phonons and larger than that of electrons or holes, one can reduce thermal conductivity by boundary scattering without affecting electrical transport. Although charge transport in thermoelectricity is almost monoenergetic (energy levels within a few kT around the Fermi energy), heat transport by phonons is broadband over the Brillouin zone. The significance of the opportunity is the ability to colloiddally-manufacture, high performance, conformal, thin film TE materials, free from the lattice and other constraints of MBE growth.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Voxtel, Inc.	Supporting Organization	Industry	Beaverton, Oregon

Primary U.S. Work Locations	
Alabama	Oregon

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines